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Removing border protection on wheat and rice: effects on rural income and food self-sufficiency in China*

Yinhua Mai†

In this paper, I use the Monash Multi-Country model – a dynamic Computable General Equilibrium model of China, Australia and the Rest of the World – to analyse the effects of removing border protection on wheat and rice in China. The analysis points to the possibility that removing border protection on wheat and rice may lead to an increase in rural income in China. This is mainly due to the following two factors. First, removing border protection on wheat and rice not only leads to a contraction in agricultural activities, but also leads to an expansion in manufacturing and services activities. Second, on average, rural households in China obtain over half of their income from manufacturing and services activities.

Key words: CGE modelling, China, rural income, wheat and rice.

1. Introduction

In per-capita terms, China is not richly endowed with resources for agricultural production. China has about one-fifth of the world's population, but has only 10 per cent of the world's arable land. Per capita water resource availability is about 2200 m^3 – 30 per cent of the world average. Per capita arable land is about 0.1 ha – 40 per cent of the world average (Zhou 2002).

Since China moved towards globalisation in the late 1970s, the manufacturing sector has expanded rapidly due to China's abundant endowment of labour. The relative importance of the agricultural sector, on the other hand, has declined from 33 per cent of Gross Domestic Product (GDP) in 1984 to around 15 per cent in 2004 (Chinese Ministry of Agriculture 2006).

On average, imports of agricultural products have been growing faster than exports during 1993–2004, leading to a consistent trade deficit for agricultural products since 1995. The deficit has widened sharply since the early 2000s (Figure 1).

The rapid growth in agricultural imports has been driven by rapid growth in demand for high-protein food by households, and for raw materials by the

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† Dr. Yinhua Mai (email: yinhua.mai@buseco.monash.edu.au) is in the Centre of Policy Studies, Monash University, Clayton Campus, Wellington Road, Clayton, Melbourne, Victoria, Australia 3800.

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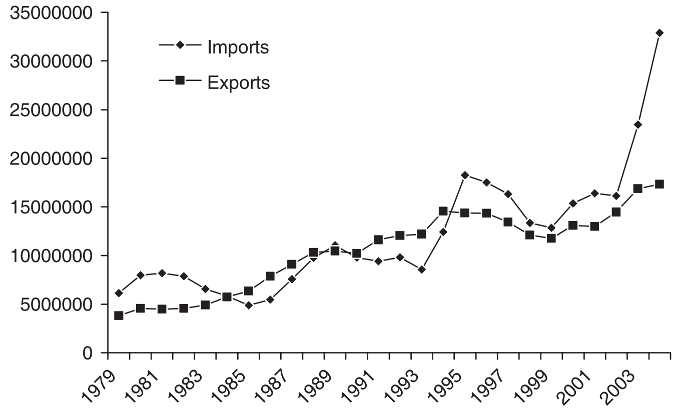

Figure 1 China: value of imports and exports of agricultural products, $US 1000.
Source: FAO, FAOSTAT 2006.
Note: The agricultural products in this chart refer to "Agriculture products, Total" in FAOSTAT (item code 1882). It includes food and agriculture products, excluding fishery and forestry products. The data was accessed in April 2006.

manufacturing sector. Table 1 lists some of the agricultural commodities or imports that have been growing rapidly.

However, cereal grains, apart from barley, are much less traded. Rice is the largest staple grain in China. The total quantity of rice traded (exports + imports) has been under 2 per cent of total domestic production. Furthermore, China has been a net exporter of rice in most years. For wheat and corn, shares of trade in production have occasionally gone up to 10–14 per cent depending on domestic harvest. While, on average, China is a net importer in wheat, it is a net exporter in corn as well (Table 2).

On the trade policy front, border protection on agricultural trade has been lowered, especially since China's accession to the WTO. However, the level of border protection on agricultural products is higher than that for manufactured goods. In 2005, the simple-average tariff rate for agricultural products was 15.3 per cent, higher than the 9 per cent for industrial products (DFAT and MOFCOM 2005).

While state control on international trade of most manufactured goods has more or less been abolished,[1] trade of agricultural products (especially staple grains) is still subject to substantial state influence. For example, 90 per cent of the Tariff Rate Quota (TRQ) for Wheat is allocated to state traders.

Like many other industrialised and industrialising countries, China faces the challenge of choosing a direction for its policy regarding trade in agricultural products. Should China further liberalise agricultural trade, especially for staple foods? How would that affect China's food self-sufficiency? Would it lead to significant reduction in rural income?

[1] Except for key energy products.

Table 1 China: quantity and value of major agricultural imports 1985–2004

	Average 1985–1994 (1)	Average 1995–2004 (2)	Ratio of (2) to (1)
Soybeans			
Quantity, Mt	2 107 688	11 257 563	5.3
Value, $US1000	536 231	2 931 464	5.5
Oil of Palm			
Quantity, Mt	709 007	1 880 130	2.7
Value, $US1000	288 424	863 528	3.0
Rubber Natural Dry			
Quantity, Mt	380 054	745 487	2.0
Value, $US1000	359 538	690 443	1.9
Oil of Soybeans			
Quantity, Mt	344 214	1 161 673	3.4
Value, $US1000	171 147	672 248	3.9
Wool, Greasy			
Quantity, Mt	130 248	189 552	1.5
Value, $US1000	385 059	659 147	1.7
Fish Meal			
Quantity, Mt	414 271	860 522	2.1
Value, $US1000	193 520	518 171	2.7
Barley			
Quantity, Mt	809 408	1 930 952	2.4
Value, $US1000	113 235	331 577	2.9
Animal Oil, Fats and Greases			
Quantity, Mt	158 894	350 146	2.2
Value, $US1000	62 095	148 417	2.4
Cassava Dried			
Quantity, Mt	297 673	1 137 750	3.8
Value, $US1000	19 333	104 459	5.4
Meat Meal			
Quantity, Mt	63 358	153 095	2.4
Value, $US1000	20 459	45 580	2.2
Cotton Carded Combed			
Quantity, Mt	7910	19 491	2.5
Value, $US1000	10 409	35 032	3.4
Butter of Cow Milk			
Quantity, Mt	9221	13 791	1.5
Value, $US1000	16 939	24 685	1.5

Source: Calculated by author from FAOSTAT data, 2006.

The aim of this study is to contribute to the understanding of the above questions. Issues concerning trade in grains are quite different from issues concerning trade in other agricultural products; they therefore warrant separate analyses. This paper focuses on the effects of removing border protection on wheat and rice, the main staple foods for China.

The methodology employed in this study is a dynamic Computable General Equilibrium (CGE) model (the Monash Multi-Country model – MMC) to simulate the effects of removing border protection on wheat and rice. A verbal description of the MMC model is contained in Box 1 (for a more detailed model documentation, see Mai 2004).

Table 2 China: production and trade of selected agricultural products 1994–2004, 10 000 tonnes, %

	Production	Imports	Exports	Share of trade in production
Rice				
1994	17 593	51	154	1.2
1995	18 523	165	6	0.9
1996	19 510	77	28	0.5
1997	20 073	36	95	0.7
1998	19 871	26	376	2.0
1999	19 849	19	272	1.5
2000	18 791	25	296	1.7
2001	17 758	29	187	1.2
2002	17 454	24	199	1.3
2003	16 066	26	262	1.8
2004	17 909	77	91	0.9
Wheat				
1994	9930	733	27	7.7
1995	10 221	1163	23	11.6
1996	11 057	830	57	8.0
1997	12 329	192	46	1.9
1998	10 973	155	28	1.7
1999	11 388	51	16	0.6
2000	9964	92	19	1.1
2001	9387	74	71	1.5
2002	9029	63	98	1.8
2003	8649	45	251	3.4
2004	9195	726	109	9.1
Corn				
1994	9928	0	875	8.8
1995	11 199	526	12	4.8
1996	12 747	45	24	0.5
1997	10 430	0	667	6.4
1998	13 295	25	469	3.7
1999	12 808	8	433	3.4
2000	10 600	0	1048	9.9
2001	11 409	4	600	5.3
2002	12 131	1	1166	9.6
2003	11 583	0	1639	14.2
2004	13 029	0	232	1.8
Barley				
1994	442	151	5	35.3
1995	428	157	5	37.9
1996	431	215	6	51.3
1997	431	215	6	51.3
1998	340	179	5	54.1
1999	330	253	6	78.5
2000	265	217	9	85.3
2001	289	261	10	93.8
2002	332	213	11	67.5
2003	272	148	13	59.2
2004	NA	NA	NA	NA

Source: Chinese Ministry of Agriculture 2006. FAO, FAOSTAT 2006. NA, not available.

Box 1 The Monash-Multi Country model

The analytical framework used in this study is the Monash-Multi-Country (MMC) model. The MMC model is an advanced dynamic Computable General Equilibrium (CGE) model of the Australian, Chinese and the Rest of the World economies

The core CGE theory of the MMC model is based on that of a single country model of Australia, the ORANI model (see Dixon et al. 1982 and Horridge 2001). The dynamic mechanism of the MMC model is based on that of a single country dynamic model of Australia, the MONASH model (see Dixon and Rimmer 2002). MMC uses a multi-country CGE database, the Global Trade Analysis Project (GTAP) database (See Hertel 1997 and Dimaranan and McDougall 2002). The MMC model recognises bilateral investment flows between countries by sector and is useful in analysing investment liberalization of a particular industry. This box provides a non-technical description of the model.

The model is a large system of linearised equations. The equations are mathematical representation of demand and supply conditions in goods, services and factor markets. The demand and supply equations are derived from the behaviour of various economic agents: producers, consumers, governments, exporters, importers and investors. Such behaviour (described in more details below) determines the reaction of the economic agents to changes in relative prices and economic environment. The model assumes that all the goods, services and factor markets start from an equilibrium represented in the model database. A change in economic policy (such as a tariff reduction) or economic environment (such as a drought) leads to a new equilibrium in which demand equals to supply for all goods, services and factor markets. The model serves to calculate changes to equilibrium quantities and prices of goods, services and factors (and other economic indicators) caused by the change in economic policy or environment.

The model recognises up to 57 industries each produces a category of goods or services such as greasy wool, textiles, wearing apparel and construction. In each industry **producers** use three production factors (land, a combination of skilled and unskilled labour, and a combination of capital owned by Australian, Chinese and the Rest of the World economies) and up to 57 goods and services as inputs to produce its output. In their production, producers mix material inputs and a combination of all production factors in fixed proportions. They determine the combination of production factors according to the relative prices of the production factors. If labour becomes relatively more expensive than capital, producers substitute labour for capital. In determining their demand for material inputs and production factors, producers exhibit optimisation behaviour of minimising costs to produce a certain level of output. Once the level of a material input is determined, producers chose to buy the material input from domestic or foreign sources according to relative prices. When the tariff on wheat and rice is reduced in China, Chinese users choose to use more imported variety because they become less expensive relative to domestically produced wheat and rice.

Technological change happens when producers can produce the same level of output using less of one (or all) material input(s) or production factor(s). The output produced by each industry is sold either domestically or exported.

Consumers in the model purchase various categories of goods from different sources (imported or domestically produced). They consume a bundle of necessities and luxury goods. The luxury part of their consumption is linked to their income. They exhibit optimisation behaviour in their choice of luxury consumption by maximising their utility subject to budget constraints. Consumers choose between imported and domestically produced goods according to their relative prices. When tariff on wearing apparel is reduced, consumers choose to buy more imported clothing because it becomes less expensive relative to domestically produced clothing.

Governments in the model collect direct and indirect taxes (including tariffs) and have budget expenditures. **Investors** minimise costs when they purchase various goods (imported and domestically produced) and services (mainly construction) for capital creation. Governments and investors exhibit similar behaviours to producers and consumers in their purchasing choice of imported vs. domestically produced goods.

Box 1 *Continued*

Once the level of imports for a commodity is determined by the choices of users (producers, consumers, governments and investors), **importers** can then determine which country/region to import from, again, according to relative prices. When Australia reduces its tariff on clothing imports from China under a bilateral FTA, importers choose to import more clothing from China because it becomes relatives less expensive compared to clothing produced in the Rest of the World region.

The dynamic aspect of the model enables us to analyse the effects of a policy change under a growth perspective. Under this perspective, the effects of a policy change are viewed as a change in the way the economies evolve into the future. This is achieved by producing a business-as-usual scenario from 1997 (the year of the model database) to a future year (2015 in this study). The business-as-usual scenario contains my view on what would happen to 2015 without the policy changes. It forms a bench mark with which I compare the growth path of the economies with the policy changes implemented (in this case, elimination of border protection on wheat and rice in China).

In other words, under a dynamic perspective, the calculation of the effects of a policy change depends on my view of future. For example, for an industry with a shrinking output, a negative policy impact on the industry means negative growth in output. However, for a rapidly expanding industry in the business-as-usual situation, a negative policy impact could merely mean a slower rate of positive growth rather than a negative growth in the level of output.

The business-as-usual scenario is obtained by simulating year-to-year changes happened from 1997 to 2015 to the three economies in the model, such as, growth of macroeconomic indicators, industry output and employment, and trade in agricultural products. This is made possible through the **dynamic mechanisms** in the model determining accumulation of physical capital and foreign assets and liabilities over time. The accounting of the accumulation of foreign assets and liabilities allows the accounting of GNP that is GDP plus return from foreign assets net of interest paid on foreign liabilities.

The accumulation of physical capital allows investment (net of depreciation) in a previous year be added onto the productive stock of capital in the current year. Investment in a particular industry by a particular country/region is determined by a reverse logistic function linking growth in capital stock with expected rate of return. In the current version of MMC, the expected rate of return is determined under static expectations. Under static expectations, investors only take account of current rentals and asset prices when forming current expectations about rates of return.

The model has a larger number of variables than the number of equations. Users therefore should specify a **closure** that determines which variables are to be determined exogenously. Like other ORANI-type of CGE models, there is flexibility in model closure or choosing the set of exogenous variables for the MMC model.

In a typical long-run simulation such as the ones in this paper, it is assumed that aggregate employment at the national level is determined by long-run factors such as population growth and labour force participation rates and therefore is exogenous in the simulation of removing border protection on wheat and rice. Employment by industry, however, is endogenous as labour is mobile between industries/sectors within China.

The agricultural and mining industries in the model use land/resource as a production factor. In the simulations conducted for this study, I assumed that land for each industry is a fixed production factor or is exogenous.

Source: Mai 2004.

While trade liberalisation in China has been analysed intensively using CGE models, not as much effort have been devoted to issues related to unilateral liberalisation on key staple grains, such as wheat and rice. Most of the analyses on agricultural trade focus on China’s WTO commitments (for example, see Hertel *et al*. 2000; Carter and Li 2002; Ianchovichina and Martin 2004; Kuiper and Tongeren 2004; Yu and Frandsen 2005).

Anderson *et al*. (2003) simulated China's additional WTO commitments to be implemented between 2002 and 2007 using the Global Trade Analysis Project (GTAP) model (see Hertel 1997 for model documentation). For key agricultural products, reductions in border protection were simulated for oilseeds, sugar and milk. No reduction or removal of border protection on wheat and rice were simulated in the study. The paper discussed the impact of the trade policy changes on rural income mainly through the impact of the policy change on rural farm and non-farm wages.

This paper is specifically focused on unilateral removal of border protection on wheat and rice in China. The impact of the simulated policy change on rural income is estimated in light of the composition of rural household income from farming and non-farming sectors.

The paper contains eight sections. Section 1 is the introduction which was described above. Section 2 describes the simulation of removing border protection for wheat and rice. Section 3 contains a discussion of macroeconomic effects of the simulated policy change. Section 4 contains a discussion of the industry effects. In Section 5, I explore the impact on food self-sufficiency. In Section 6, I present different simulation results for a case where the reduction in border protection for wheat and rice leads to a change in preferences. In Section 7, I discuss the impact of the policy change on the income of rural households. Section 8 highlights the main findings and further areas for research.

2. Simulating the removal of border protection for wheat and rice

To analyse the effects of removing border protection for wheat and rice, the first question to answer is what the current level of border protection is? Huang *et al*. (2004) estimated that the nominal protection rate for wheat in 2001 was 12 per cent and that for rice was –3 per cent. OECD (2005), however, estimated that the producer subsidy equivalents of Chinese wheat were negative during 2001–2003, while that of rice were slightly over 10 per cent.

During post China's WTO entry in 2001, imports of wheat and rice into China are subject to TRQ. For wheat, the in-quota rate is 1 per cent while the over-quota rate is 65 per cent. Ninety per cent of the wheat TRQ is to be allocated to state traders. For rice the in-quota rate is 1 per cent while the over-quota rate is 65 per cent. Fifty per cent of the rice TRQ is to be allocated to state traders.

By 2005, neither wheat nor rice TRQ had been filled. The level of TRQ was about 10 per cent of domestic consumption for wheat and under 3 per cent for rice. Table 2 shows that, since 1994, imports of wheat would occasionally approach or exceed 10 per cent of domestic consumption. Imports of rice, however, remained under 2 per cent. Under the TRQ scheme, when TRQ is filled, the effective border protection would be the over-quota rate of 65 per cent.

To summarise, the effective border protection for wheat and rice ranges from a small tax to 65 per cent according to literature and the TRQ arrangement under the WTO.

Box 2 Baseline – a business-as-usual scenario

The modelling starts from the Global Trade Analysis Project (GTAP) database (Dimaranan and McDougall 2002) which is a snapshot in 1997 of the economic structures of various economies in the world and the economic linkages between them. In the baseline simulation, I inform the model how the Australian, Chinese and the Rest of the World (ROW) economies evolved from 1997 to 2003 using historical data; and how the three economies are likely to evolve from 2003 to 2015 using forecast data. The main sources of the historical and forecast data are Access Economics (a private consulting firm located in Australia), the Australian Bureau of Statistics, the World Bank, the International Monetary Fund, Economist Intelligence Unit, the China National Bureau of Statistics, FAO, Chinese Ministry of Agriculture and the Chinese Academy of Social Sciences.

The growth rates of key economic indicators in the baseline, expressed as average annual growth rates between 1997 and 2015, are presented in Table 3. These indicators include real GDP, consumption, investment, exports and imports at the macroeconomic level, and industry output for aggregated sectors. Features of the baseline include:

1. Rapid growth in Chinese real GDP at a rate twice that of Australia's real GDP;
2. Growth in trade volumes in both countries in excess of growth in real GDP; and
3. Continued shifts from manufacturing to services in Australia and declining shares of agriculture and mining in Chinese real GDP.

I assume that real GDP of ROW grows at an average annual rate of 2.4% between 1997 and 2015.

Table 3 Baseline: macroeconomic indicators Average annual growth rates 2005–2015, %

	Australia	China
Macroeconomic indicators		
Real GDP	3.3	6.7
Real consumption	3.4	5.8
Real investment	2.9	6.6
Export volumes	3.9	9.2
Import volumes	3.7	8.2
Output of aggregated sectors		
Agriculture	2.4	2.6
Mining	3.2	6.3
Manufacturing	2.1	7.4
Services	3.4	6.7

Source: Baseline simulation.

To estimate an upper bound impact of removing border protection on wheat and rice, a reduction of 65 percentage points in border protection on both wheat and rice is simulated in this paper. The reduction in tariff equivalents of 65 per cent is assumed to be implemented in five years from 2006 to 2010.

To analyse the effects of the policy change, I compare the policy scenario (the economic growth path with the policy change in-place) with a baseline scenario from 2005 to 2015 (Figure 2). The baseline shows how the economy is likely to evolve without the removal of border protection on wheat and rice (Box 2 and Table 3).

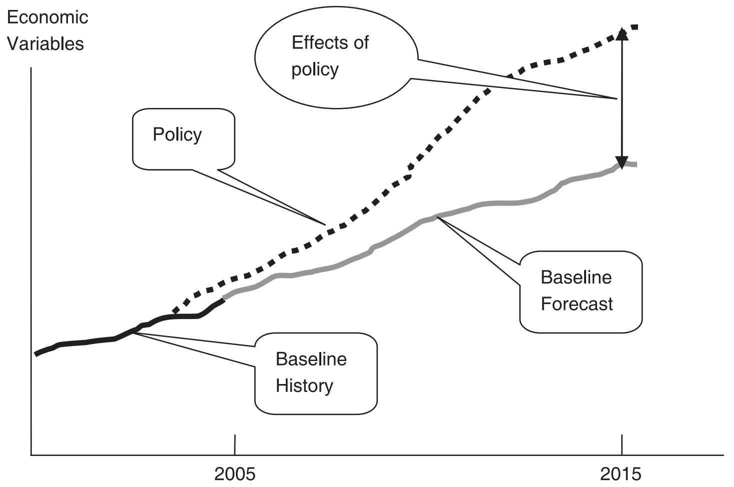

Figure 2 History, baseline forecasts and policy simulations.

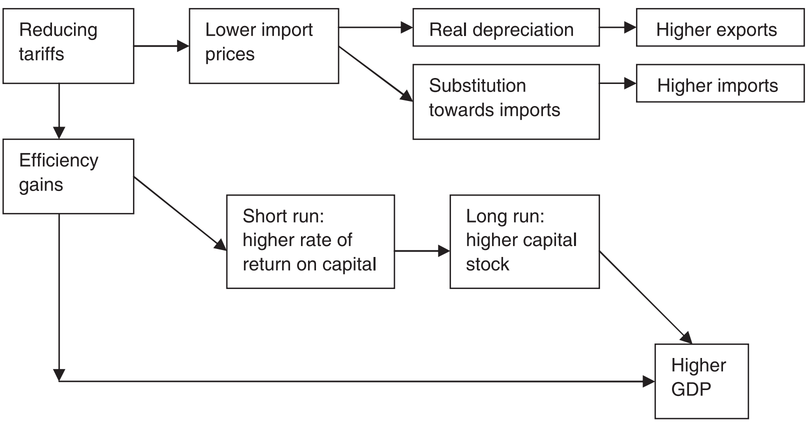

Figure 3 Removing border protection on wheat and rice: macroeconomic effects.

The baseline serves as a business-as-usual scenario, or reference case, against which scenarios containing policy changes are compared. The effects of removing border protection on wheat and rice is measured as deviation of each economic variable from its baseline growth path (Figure 2).

3. Macroeconomic effects

Figure 3 shows that, at the macro level, the reduction in tariff equivalent leads to lower import prices that, in turn, leads to a higher level of imports as users substitute domestic goods for imports. The lower import prices also lead to a real depreciation and thus a higher level of exports compared to the baseline. The efficiency gains following the reduction in tariffs leads to, in the

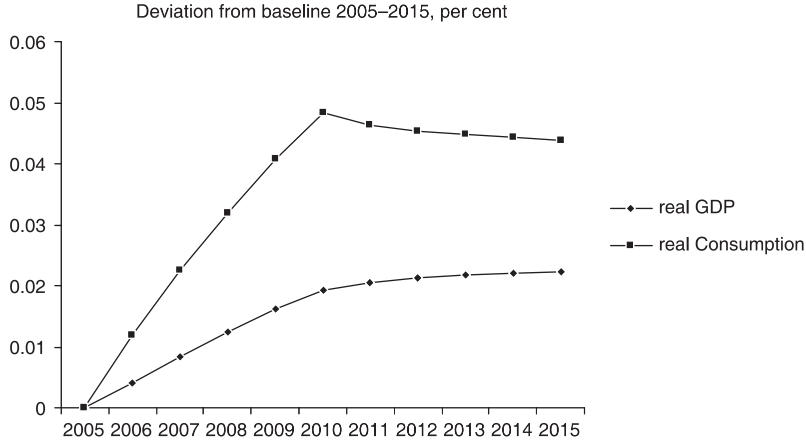

Figure 4 Removing border protection on wheat and rice: macroeconomic effects.
Source: Simulation results.

short-run, a higher rate of return on capital and, in the long-run, a higher level of capital stock. The efficiency gains plus the higher capital stock lead to a higher level of real GDP.

Overall, the reduction in tariff equivalent on wheat and rice leads to a positive change in real consumption and GDP. The size of the changes is small because the share of wheat and rice in total GDP is small in China. Figure 4 shows that, if border protection of 65 per cent on wheat and rice was removed, China's real GDP would be 0.02 per cent higher by 2015, and real consumption would be 0.04 per cent higher compared to the business-as-usual scenario.

In the policy simulation, I assumed that the removal of border protection on wheat and rice did not lead to improvement in productivity in wheat and rice production in China. If the endogenous productivity growth induced by more intensive import competition is taking into account, the macroeconomic effects are likely to be bigger than those presented in this paper.

4. Industry effects

The removal of border protection on wheat and rice leads to a lower output for China's wheat and rice industries relative to the baseline (Figure 5). This is because the policy change lowered the price of imported wheat and rice, and users therefore substitute domestically produced wheat and rice for imports.

The manufacturing and services sectors, on the other hand, expands as a result of the removal of border protection on wheat and rice. The reduction on tariff equivalent leads to real depreciation. This benefits the more export-orientated manufacturing sector. The more efficient resource allocation following the removal of border protection on wheat and rice also benefits the manufacturing and services sectors (Figure 6).

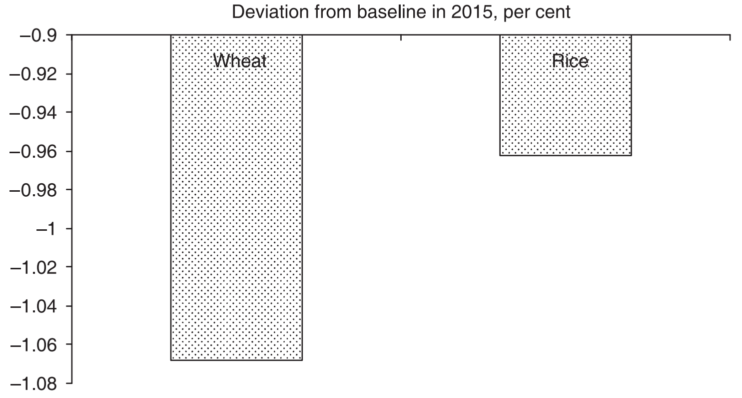

Figure 5 Effects of removing border protection on wheat and rice: the output of the wheat and rice industries.
Source: Simulation results.

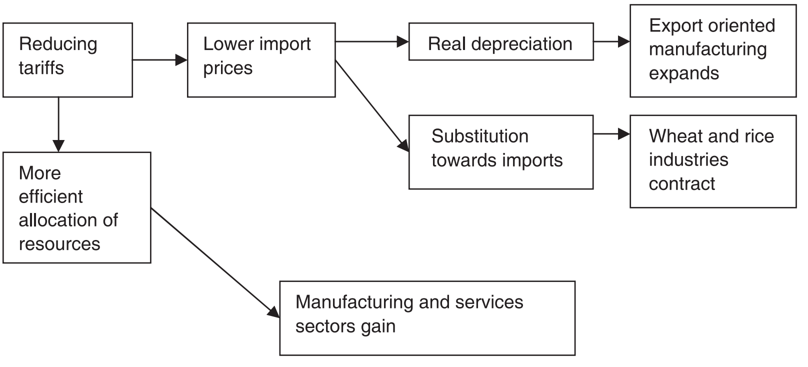

Figure 6 Effects of removing border protection on wheat and rice: industry effects.

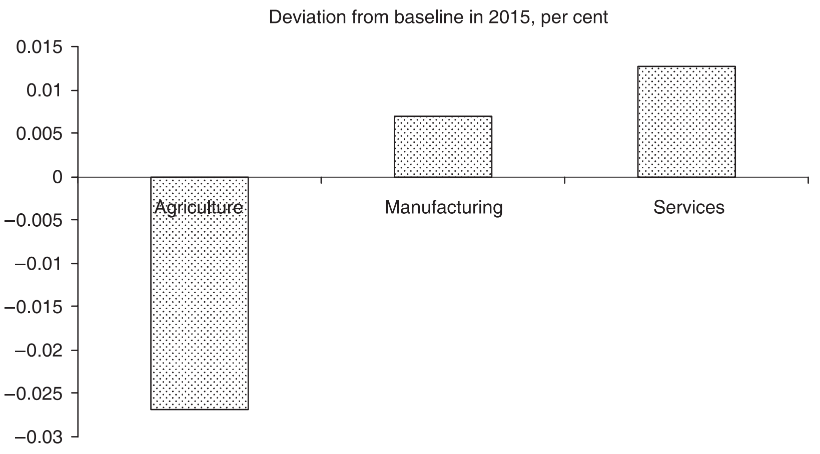

Figure 7 Effects of removing border protection on wheat and rice: industry results.
Source: Simulation results.

Figure 7 shows that, while agricultural output falls following the removal of border protection on wheat and rice, the output of the manufacturing and services sectors rise relative to baseline.

5. Impacts on food self-sufficiency

The indicator used for food self-sufficiency in this study is defined as the share of imports in total domestic consumption. The total domestic consumption is defined as the sum of domestic production and imports minus exports:

$$\text{Domestic consumption} = \text{Domestic production} + \text{Imports} - \text{Exports} \tag{1}$$

Figure 8 shows that, as a result of the removal of border protection on wheat and rice, wheat imports are likely to rise to over 12 per cent of total domestic consumption in 2015, 2 percentage points higher than the baseline. Similarly, rice imports are likely to rise to over 3 per cent of total domestic consumption, 1.5 percentage points higher than the baseline.

Notice that, in the baseline simulation, I assumed that wheat imports grow steadily so that the TRQ for wheat is filled by 2015. Wheat imports in the baseline therefore account for about 10 per cent of the total domestic consumption in 2015 (Figure 8). Rice imports, on the other hand, are assumed to remain low at about 1–2 per cent of total domestic consumption.

The simulation results seem to suggest that a 65 per cent reduction in tariff equivalents leads to 2 percentage points rise in the share of imports in total domestic consumption for wheat – a rather affordable rise in terms of China's export earnings. In 2005 China's wheat consumption is about 79 million tonnes (FAOSTAT). Valued at Australian producer price (US$145 per tonne

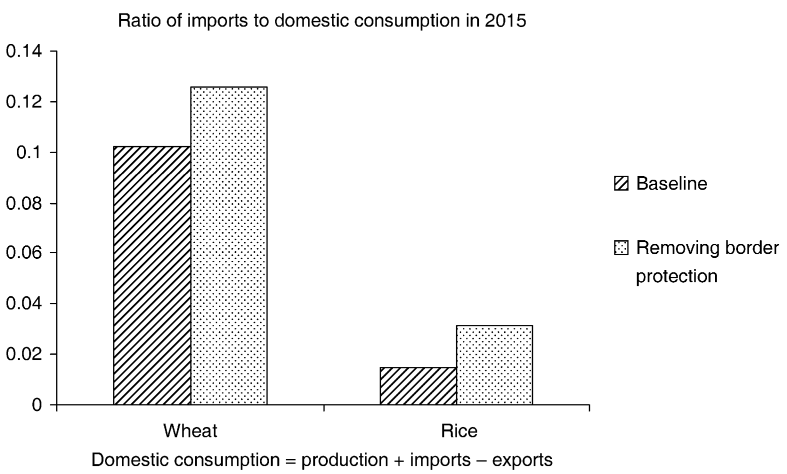

Figure 8 Effects of removing border protection on wheat and rice: food self-sufficiency.
Source: Simulation results.

– FAOSTAT), the 2 percentage points wheat consumption is about 0.03 per cent of China's export earnings that was US$835 billion in 2005 (WDI).

Is this result believable? To shed light on this question, it is necessary to examine key assumptions made in this simulation.

First, in this simulation, I assumed that the wheat TRQ is to be filled by 2015. A different assumption can be made in the baseline to see whether or not this affects the simulation results.

Second, as mentioned before, I assumed that the reduction in tariff equivalents does not lead to endogenous productivity improvement. The extent to which this affects the simulation results can be investigated by assuming that a reduction in tariff equivalents does lead to productivity improvement in the wheat and rice industries in China.

Third, in this simulation, I assumed that the increased consumption of imported wheat and rice does not lead to a change in consumer tastes. In reality, however, once consumers and manufacturers have access to imported wheat and rice, there is a possibility that they may develop a preference towards imported varieties.

Investigating all of the above issues is beyond the scope of this paper. However, the next section presents a set of simulation results with the assumption that the reduction in tariff equivalents leads to a user preference change in favour of imported wheat and rice.

6. What if reducing tariff leads to a change in preferences?

In general, demand for imported wheat and rice is negatively related to the corresponding prices. In the model, purchasers of imported wheat and rice compare the import prices with the price of domestically produced wheat and rice. The slope of the demand curve for imported wheat and rice is determined by import shares and the Armington elasticity. The values of Armington elasticities in the MMC model are inherited from the MONASH model (Dixon and Rimmer 2002). I conducted a sensitivity analysis by increasing the Armington elasticity by 50 per cent. The main conclusions of the study are not sensitive to the change in the magnitude of the Armington elasticity.

However, the position (or the shift) of the demand curves for imported wheat and rice can be an important factor influencing the key findings of this paper. In other words, factors in addition to relative-price changes may affect levels of demand for imported wheat and rice. One such factor is user preference towards imported vs. domestically produced goods.

From data presented in Table 2, one can see that the level of imports of wheat and rice has been very low compared to total domestic consumption. Furthermore, most of the wheat imports have been for the purpose of maintaining the level of stocks. A reduction in border protection may well serve to expose Chinese consumers to imported varieties of wheat and rice. This, in turn, may lead to an increase in user preference towards imported varieties in China.

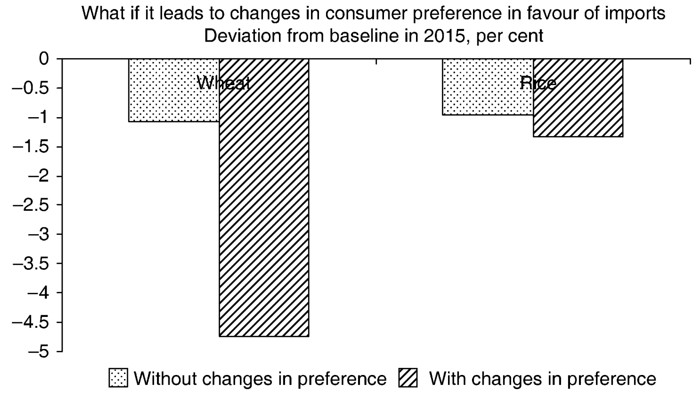

Figure 9 Effects of removing border protection on wheat and rice: the output of wheat and rice industries.
Source: Simulation results.

In my historical simulations, I repeatedly found that relative-price changes alone are not sufficient to explain the rapid expansion of world trade observed in historical periods. In an age of rapid globalisation, economic agents in various countries seem inclined to use more imports than would be suggested by relative-price changes. In other words, there has been a shift in user preferences towards imported goods in many countries.

To investigate the consequences of a possible shift in user preference in favour of imported wheat and rice, I simulated the tariff reduction again assuming the tariff reduction leads to 5 percentage-points increase in the ratio of imports to domestically produced wheat and rice. The results are discussed below.

When the reduction in tariff equivalent leads to a change in user preferences in favour of imported wheat and rice, the negative impact on the output of wheat and rice is larger (Figure 9). In particular, the output of the wheat industry is nearly 5 per cent lower compared to baseline. The impact is much larger compared to the situation when no preference changes are assumed (1 per cent, Figure 9). The manufacturing and the services sectors, on the other hand, also expand more (Figure 10).

Figure 11 shows the difference in the impact on food self-sufficiency with and without changes in user preferences. For rice the difference is moderate. However, for wheat, imports may account up to over 15 per cent (instead of just over 12 per cent) of total domestic consumption if the reduction in tariff equivalents leads to a change in user preferences in favour of imported varieties.

7. Impacts on rural income

The simulation results show that the removal of border protection on wheat and rice leads to a positive change in rural income:

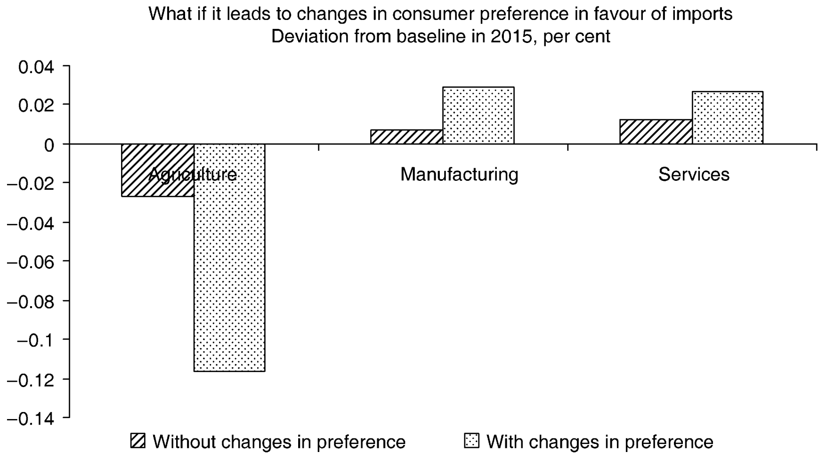

Figure 10 Effects of removing border protection on wheat and rice: industry results. *Sourcse*: Simulation results.

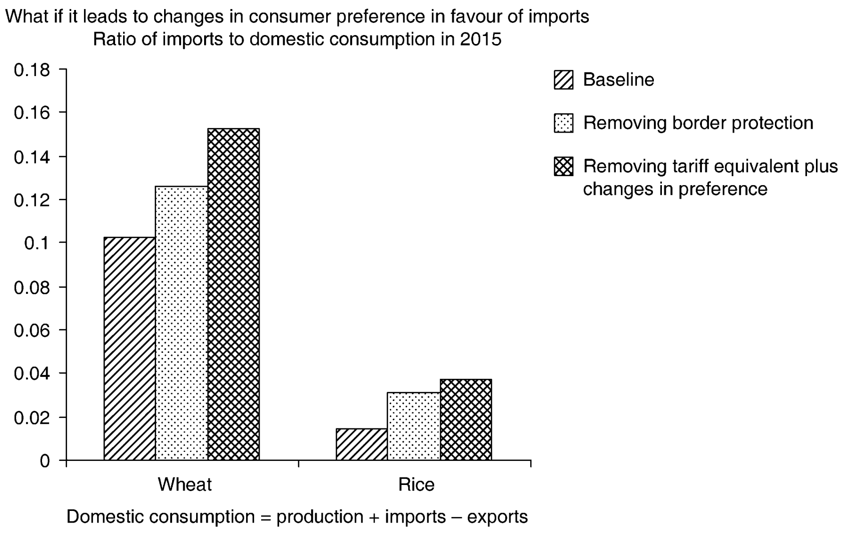

Figure 11 Effects of removing border protection on wheat and rice: food self-sufficiency. *Sourcse*: Simulation results.

- the deviation of rural income from baseline in 2015 is 227 million yuan; and
- on average, the income of each rural labour increases by 0.46 yuan in 2015 compared to baseline.

This result is rather unexpected. When output of the agricultural sector falls relative to baseline, we would typically expect rural income to fall as well. So why did the simulation results show a rise in rural income?

The key reason lies in the share of rural income by source. In the model baseline, I assumed that the share of rural income by source in 2015 is the following:

Table 4 Sources of rural income 2003

	Total 100 million yuan	Of which: family operation 100 million yuan	Total %	Of which: family operation %
Total rural income	131 719	64 909	100.0	100.0
1. Agriculture	14 542	14 044	11.0	21.6
of which crops	13 175	12 808	10.0	19.7
other agriculture	1367	1236	1.0	1.9
2. Forestry	902	808	0.7	1.2
3. Animal husbandry	7155	6844	5.4	10.5
4. Fishing	1974	1645	1.5	2.5
5. Manufacturing	74 115	22 589	56.3	34.8
6. Construction	7892	4098	6.0	6.3
7. Transportation	5734	4674	4.4	7.2
8. Trade and hotel	12 046	6086	9.1	9.4
9. Other services	3326	2103	2.5	3.2
10. Other income	4033	2018	3.1	3.1

Source: Chinese Ministry of Agriculture, http://www.agri.gov.cn, accessed October 2005.

Table 5 Rural employment by activities 2003, persons per household

	China	East	Middle	West
Family total	2.50	2.48	2.45	2.59
Agriculture	1.40	1.12	1.48	1.60
Manufacturing	0.25	0.38	0.21	0.17
Construction	0.10	0.09	0.11	0.11
Transportation	0.06	0.07	0.05	0.06
Trade, hotel and restaurants	0.20	0.23	0.17	0.19
Other activities	0.49	0.59	0.42	0.46

Source: Chinese Ministry of Agriculture, http://www.agri.gov.cn, accessed October 2005.

- Agriculture 19 per cent
- Manufacturing 56 per cent
- Services 22 per cent
- Others 3 per cent

This assumption is based on the Chinese Ministry of Agriculture data presented in Tables 4–6. Table 4 shows that 56 per cent of total rural income comes from the manufacturing sector. Agricultural crops, on the other hand, only contribute to 10 per cent of total rural income. Table 5 shows that, on average, each family have about 2.5 economically active people and only 1.4 of them are employed in agricultural activities. The rest are mainly employed in manufacturing and services sectors. Table 6 shows that the share of rural labour force employed in non-agricultural activities has been increasing rapidly over the past two decades. From 1983 to 2003, the share of rural

Table 6 Rural labour force 1983–2003, 10 000 persons

	Total rural labour force	Agriculture	Shares (%)	Non-agriculture	Shares (%)
1983	34 690	31 645	91.2	3045	8.80
1993	44 256	33 258	75.2	10 998	24.8
2003	48 971	31 260	63.8	17 711	36.2

Source: Chinese Ministry of Agriculture, http://www.agri.gov.cn, accessed October 2005.

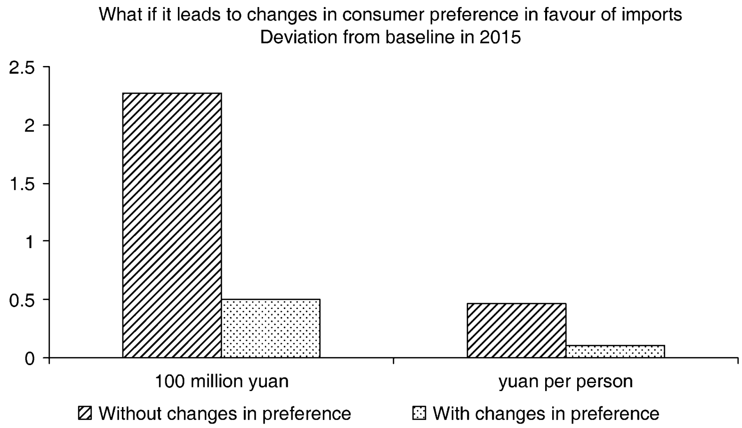

Figure 12 Effects of removing border protection on wheat and rice: rural income.
Source: Simulation results.

labour force employed in non-agricultural activities increased from 9 to 36 per cent.

Since the manufacturing and services sector expands following the removal of border protection on wheat and rice, and non-agricultural income has become a dominant source for rural households, the policy change may lead to a positive rather than negative change in total rural income.

Figure 12 shows the effects when the reduction in tariff equivalents on wheat and rice leads to a change in user preferences in favour of imports. The effects on rural income are still positive, but smaller.

It is important to note that the simulation results are based on national-average data for China. For different regions, the results can be quite different. Further analysis using regional models is therefore necessary to enhance the understanding of the effects on rural income in different regions in China.

8. Concluding comments

Using a dynamic CGE model, I simulated the effects of a 65 percentage-points reduction in tariff equivalents for wheat and rice in China. The results show that the policy change does not lead to a dramatic change in the share of imports in total domestic consumption of wheat and rice. The impact of the policy change on rural income may turn out to be positive.

Two factors lead to the positive impact of the tariff removal on rural income. The first is that the removal of border protection on wheat and rice leads to expansion of the manufacturing and services sectors (Figure 7). The second is that most of rural household income comes from the manufacturing and services sectors (Table 4).

However, this study did not take into account difference across regions of China. While the removal of border protection on wheat and rice may lead to a rise in the income of rural households that source most of their income from the non-farm sectors, the impact on rural households in the regions that mainly rely on the production of staple food may suffer a reduction in their income. In the next version of the model, I hope to investigate the removal of agricultural protection on the income of rural households in different regions of China.

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